NAS MEMPHIS
TECHNICAL MEMORANDUM
SWMUs 4 and 5

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TECHNICAL MEMORANDUM

TO: Allison Drew, RPM, EPA Region IV

FROM: Mark Taylor, EIC, SOUTHNAVFACENGCOM

SUBJECT: NAS Memphis RFI — Interim Measures Field and Analytical Summary

DATE: February 23, 1993

INTRODUCTION

Field work for the NAS Memphis Interim Measures activity at the Aircraft Fire Fighting Training Area (FFTA) was conducted by the U.S. Geological Survey (USGS) during October 19-25, 1992 with additional sampling accomplished on December 17, 1992. This work was conducted in support of two planned Military Construction Projects (Firemat Training Mock-Up Facility/Shore Aircraft Fire and Rescue Training Facility [SATF]). The field work was designed to determine if activities at Solid Waste Management Units (SWMUs) 4 and 5 have impacted the soils and sediments in the planned construction areas, and also the potential impact that any contaminants would have on site workers during construction.

FIELD WORK SUMMARY

Field work consisted of drilling 10 shallow soil borings from the surface to the water table. Three subsurface soil samples were collected from each boring and nine sediment samples were collected from the ditches and drainageways that traverse the investigation area. On December 17, five supplemental sediment samples were collected from the drainage ditch upgradient of the investigation area to further characterize the limited portion of SWMU 4 affected by the proposed construction of the SATF.

Each soil boring location was laid out by compass and tape measure consistent with the locations identified on Interim Measures Work Plan (IMWP) Figure 3-5. Minor adjustments had to be made to the location of Boring #3 because it was not possible to position the drill rig directly over the SWMU 4 drainage ditch. The locations of all soil borings are shown in Figure TM-1 (Attachment A) of this technical memorandum.

In accordance with Sections 2.2 and 4.5 of the IMWP, samples were collected from the intervals of 0-2 feet, 5-7 feet, and 10-12 feet below land surface in all the borings except Boring #1 and Boring #10. Boring #1 was the first soil boring drilled and samples were collected from intervals of 0-2 feet, 4-6 feet, and 16-18 feet below land surface to determine the approximate depth that water could be expected to be encountered in each of the subsequent borings. In Boring #10, the deepest sample interval was 11-13 feet below land surface because of an increase in land-surface altitude of approximately 1-2 feet from the location of Boring #9.

In most of the soil borings, visual confirmation of water table intersection occurred in the 10-12 foot sampling interval. Due to the shallow depth of the water table and for consistency, the intermediate samples for analysis were collected from the 5-7 foot range in all borings. Nine sediment samples were collected from the drainage ditches following the methods described in Sections 2.2 and 4.5 of the IMWP. Seven of the sediment sample locations conformed to the locations shown in Figure 4-4 of the IMWP. Two additional sediment samples were collected from a low area parallel to Access Road No. 2 because this appeared to be a pathway for runoff to the SWMU 4 ditch. Five additional locations were sampled in the ditch upgradient of the FFTA. The five additional samples were needed to characterize a limited section of the ditch that will be re-contoured in conjunction with planned construction of the SATF. The locations of all sediment samples are shown in Figure TM-2 (Attachment A).

ANALYTICAL QUALITY ASSURANCE/QUALITY CONTROL SUMMARY

In all, 50 solid-phase environmental samples were collected, including 30 subsurface soil samples, three soil duplicates, one soil matrix spike, one soil matrix spike duplicate, 14 sediment samples, and one sediment duplicate. All samples were shipped under chain of custody by overnight carrier to the Enseco-Rocky Mountain Analytical Laboratory (RMAL) in Arvada, Colorado, for determination of the following RCRA Facility Investigation (RFI) analytes:

- Volatile Organic Compounds (EPA Method 8240)
- Semivolatile Organic Compounds (EPA Method 8270)
- Total Petroleum Hydrocarbons (EPA Method 418.1)
- Total Cyanide (EPA Method 9010)
- Organochlorine Pesticides/PCBs (EPA Method 8080)
- RCRA Part 264, Appendix IX Metals (EPA Method 6010/7000 series)

Quality assurance/quality control protocols were adhered to throughout the investigation as described in the IMWP. In addition to the solid-phase samples listed above, QA/QC included the collection of potable and deionized/organic-free water field blanks, five sets of rinsate blanks, and one trip blank for each of the 13 coolers used to ship samples to the lab. All expendable field sampling supplies (i.e., bottles, preservatives, labels, chain-of-custody forms, and trip blanks) used in the investigation were supplied by RMAL.

Potable and deionized/organic-free water for field blanks were obtained from the NAS Memphis public water system and the Memphis Subdistrict Office of the USGS, respectively. All pertinent data from the field investigation was recorded in a bound field logbook, or on boring logs and specially designed forms for recording field equipment calibration and data results.

INTERIM MEASURES FIELD INVESTIGATION DATA SUMMARIES

Tables TM-1 through TM-5 (Attachment B) summarize validated positive results for volatile organic compounds, semivolatile organic compounds, pesticides, total petroleum hydrocarbons, and inorganic analytical data, respectively.

Tables TM-1 and TM-2 indicate that the only significant hits for volatile and semivolatile organic compounds were outside the area where the proposed fire mat will be physically located. Petroleum constituents were detected in samples from Boring #10 at depths of 5 feet and greater. As Figure TM-1 illustrates, Boring #10 is located southwest of the proposed area of construction.

Boring #10 was also the only boring with positive results for total petroleum hydrocarbons (TPH), as shown in Table TM-3. At the mid-boring interval of 5 to 7 feet, a concentration of 1,010 mg/kg TPH was obtained. Other significant TPH hits were obtained in sediment samples in the SWMU #4 ditch east of the FFTA (samples IM-M-6-0, IM-M-6R-0, and IM-M-10-0) and in a side ditch leading from the existing fire mat area to SWMU #4 (sample IM-M-5-0). Sample IM-M-6R-0 was a set of duplicate samples collected during the second sampling event to check the accuracy of the original sample from that location. Sample results were approximately 50 percent lower for the second sampling event. The presence of TPH in these ditches could be attributable to ongoing training activities at both the FFTA and the Carrier Deck FFTA which is northeast of SWMU #5. TPH was not detected in the sediment sample (IM-M-9-0) which was collected farthest downstream toward Big Creek.

Dieldrin was detected near the surface in 8 of 10 borings and in two sediment samples. Its widespread presence near the surface is a result of soil treatment around runways in the early 1970s. The treatment was part of a U.S. Department of Agriculture (USDA) quarantine program aimed at controlling the spread of white fringed beetles. The presence of dieldrin should be prevalent over the entire north side of NAS Memphis due to aerial application of this pesticide during the USDA program. Of the contaminants detected at the site, construction workers are more likely to be exposed to dieldrin because of its presence near the surface. The presence of dieldrin may not be a significant problem because the area of construction is lower than the rest of the FFTA, so excavation activities should be limited, if required at all. A more likely scenario is bringing in fill material to raise the elevation of the new fire mat, decreasing the likelihood of exposure.

To further evaluate the risk of dieldrin exposure, a risk calculation (Attachment C) was performed for ingestion and dermal contact of dieldrin in an industrial area assuming a 25-year duration (260 days/year). The amount of dieldrin required in an air pathway exposure (soil suspended in air) that would exceed the PEL for a worker equals 287 grams/m^3 (assumes 100 percent transfer to the bloodstream). This worst-case exposure concentration should not occur. However, engineering controls such as dust suppression or real-time air monitoring could be implemented to protect workers, if deemed necessary by a health and safety professional.

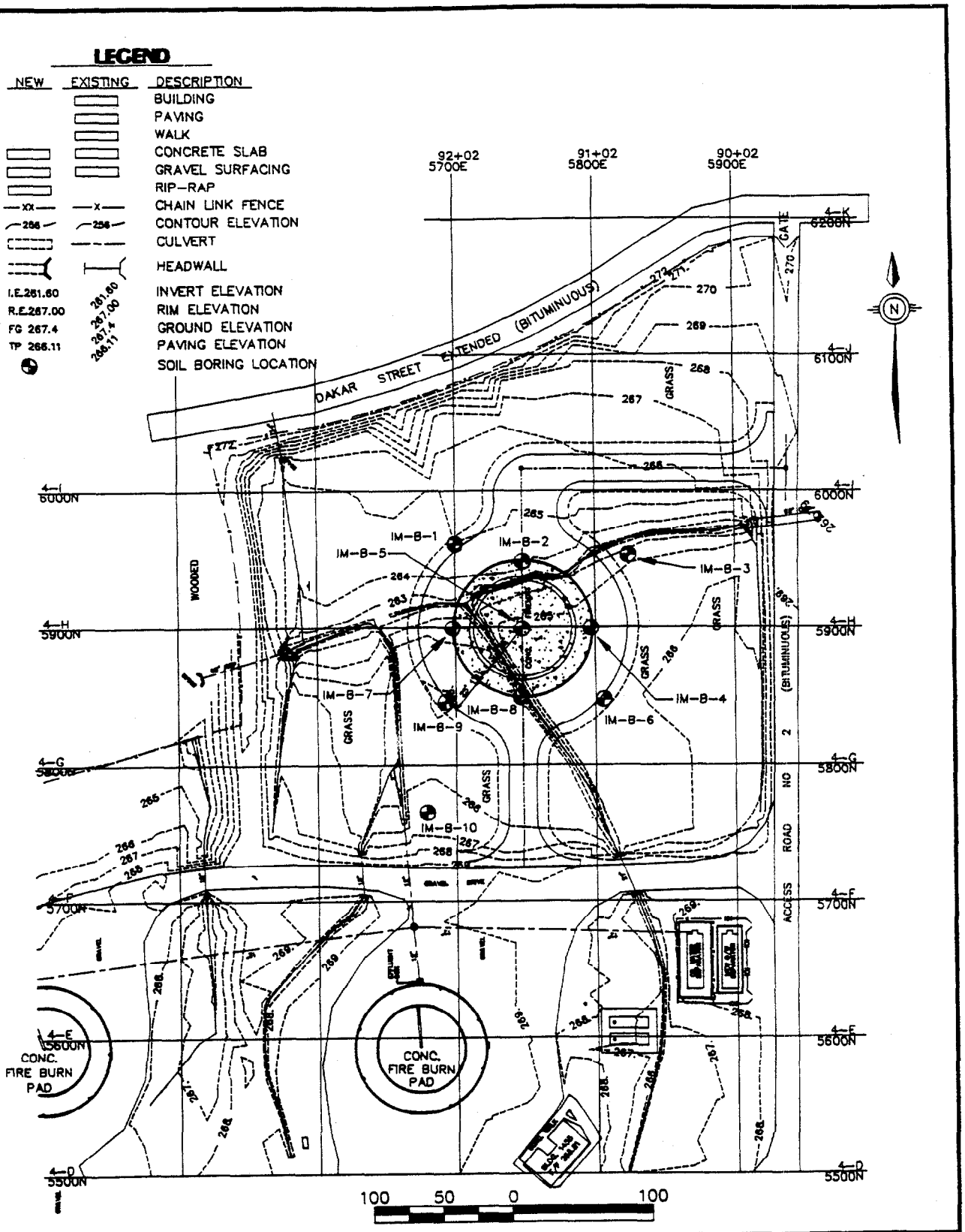
Results of inorganic analyses for metals and cyanide are summarized in Table TM-5. In general, concentrations were higher in the sediment samples than in the subsurface samples. However, a literature search indicates that all of the values are within the range of typical concentrations found in uncontaminated soils. The values for inorganic analytes were also compared to the RCRA Subpart S action levels in 40 CFR Part 264.521(a)(2)(i-iv). With the exception of beryllium, all values were well below their respective action levels. All of the beryllium values exceeded the 0.2 mg/kg action level for soil. Naturally occurring levels of beryllium could easily exceed this low action level. All but one of the beryllium values reported for the Interim Measure samples were less than 1 mg/kg which is well within the typical range of 0 to 5 mg/kg beryllium found in uncontaminated soils (*Criteria for Contaminated Soil/Sediment Cleanup*, J. Fitchko, 1989). Soil samples from the Interim Measure Investigation at SWMU 1 had similar beryllium concentrations. Therefore, the beryllium that was reported for samples from SWMUs 4 and 5 is believed to be naturally occurring.

CONCLUSIONS AND RECOMMENDATIONS

After reviewing the data generated from the Interim Measures Investigation, SOUTHDIV does not feel that workers involved in construction of the additional fire mat and SATF will be exposed to adverse health risks from surficial contamination in the areas proposed for construction. SOUTHDIV believes the risk is low because construction of the new fire mat will be more likely to require filling in low areas than excavating new areas. Also, the SATF will fill approximately 400 feet of SWMU 4, and a new ditch will be constructed to reroute storm water. Therefore, SOUTHDIV recommends that no further action be required in the Interim Measures Investigation area and all data generated under this investigation be cataloged as supplemental data for use in the RFI for SWMUs 4 and 5. Corrective measures, if any, should be included with those for the entire site following complete RFI characterization.

ATTACHMENT A

Figures

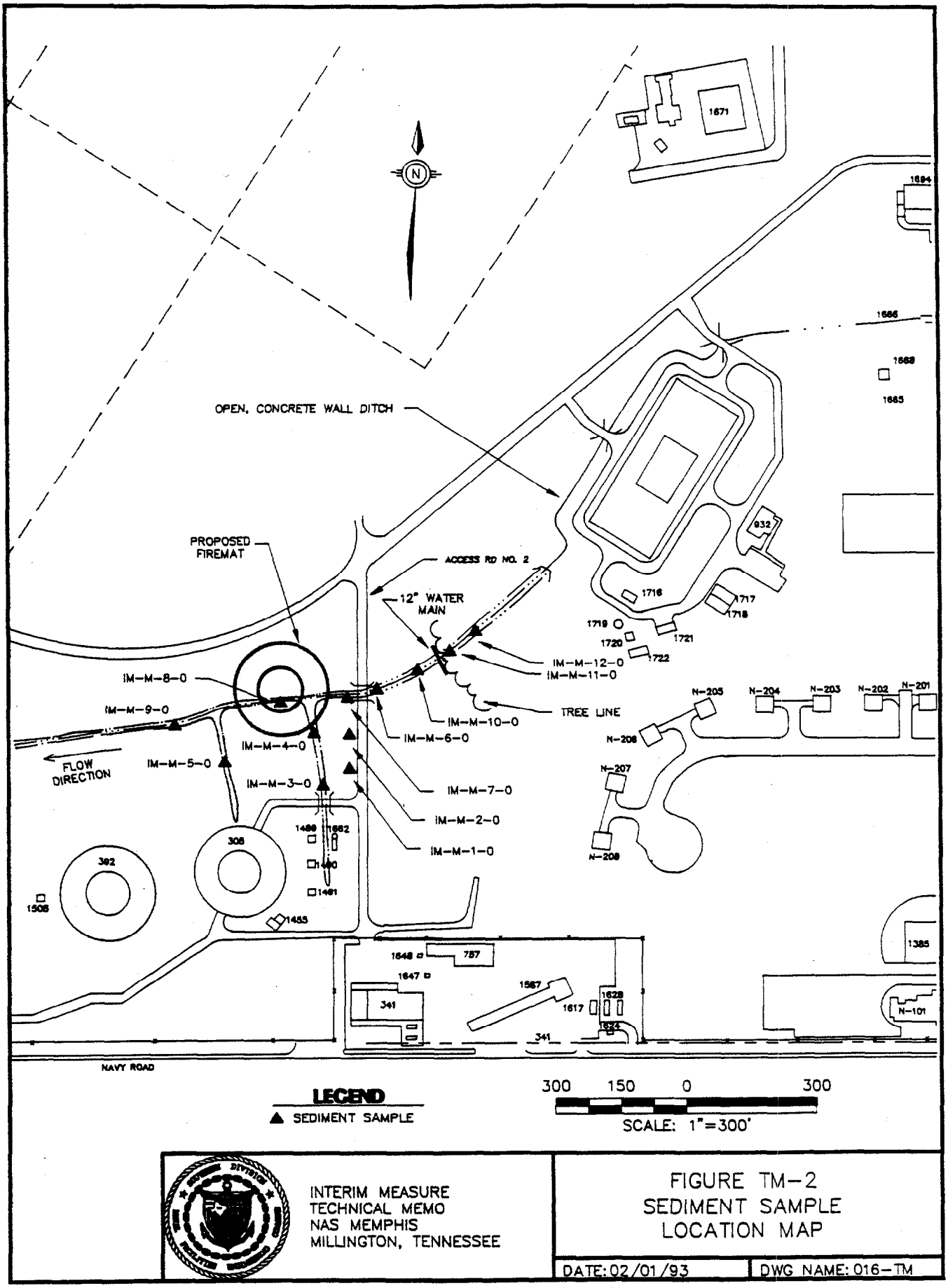


INTERIM MEASURE
TECHNICAL MEMO
NAS MEMPHIS
MILLINGTON, TENNESSEE

FIGURE TM-1
INTERIM MEASURE
SOIL BORING
LOCATION MAP

DATE: 02/01/93

DWG NAME: 016-TM1



INTERIM MEASURE
TECHNICAL MEMO
NAS MEMPHIS
MILLINGTON, TENNESSEE

FIGURE TM-2
SEDIMENT SAMPLE
LOCATION MAP

DATE: 02/01/93

DWG NAME: 016-TM

ATTACHMENT B

Data Summary Tables

NAS Memphis RFI
Interim Measure - SWMUs 4 & 5

Table TM-1
Summary of Validated Positive Results
Volatile Organic Compounds
(mg/kg)

	Sample IM-B-1-0 (0-2 ft)	Sample IM-B-1-4 (4-6 ft)	Sample IM-B-1-16 (16-18 ft)	Sample IM-B-6-0 (0-2 ft)	Sample IM-B-6-5 (5-7 ft)	Sample IM-B-7-5 (5-7 ft)	Sample IM-B-10-5 (5-7 ft)	Sample IM-B-10-11 (11-13 ft) (duplicates)	Sample IM-M-8-0 (Sediment)
Acetone	4.60		0.35	0.34	0.22	0.96	6.70	0.43/0.15	
Benzene							5.20	0.17/0.10	
1,1-Dichloroethene						0.27/0.29 MS/MSD			
1,2-Dichloroethene									0.10
Xylenes (total)		0.52					14.00		

Table TM-2
Summary of Validated Positive Results
Semivolatile Organic Compounds
(mg/kg)

	Sample IM-B-10-5 (5-7 ft)	Sample IM-B-10-11 (11-13 ft) (duplicates)	Sample IM-M-2-0 (Sediment)
Naphthalene	10.00		
2-Methylnaphthalene	44.00	1.20/ND	
Benzo(b)fluoranthene			1.80
Fluoranthene			2.30

Table TM-3
Summary of Validated Positive Results
Total Petroleum Hydrocarbons
(mg/kg)

Sample I.D. Number	Sample Depth	TPH Concentration
IM-B-10-5	5-7 ft	1,010
IM-B-10-11 (duplicates)	11-13 ft	33.1/ND
IM-M-1-0	Sediment	23.0
IM-M-2-0	Sediment	28.6
IM-M-3-0	Sediment	29.7
IM-M-4-0	Sediment	45.4
IM-M-5-0	Sediment	292
IM-M-6-0	Sediment	660
IM-M-6R-0 (duplicates)	Sediment	279/332
IM-M-7-0	Sediment	50.9
IM-M-10-0	Sediment	261
IM-M-11-0	Sediment	43.9
IM-M-12-0	Sediment	32.1

Table TM-4
Summary of Validated Positive Results
Pesticides
(mg/kg)

Sample I.D. Number	Sample Depth	Dieldrin Concentration	Data Qualifier
IM-B-1-0	0-2 ft	0.31	V
IM-B-2-0	0-2 ft	0.78	V
IM-B-2-5	5-7 ft	0.07	V
IM-B-3-0	0-2 ft	1.0	V
IM-B-5-0	0-2 ft	0.14	
IM-B-5-5	5-7 ft	0.04	
IM-B-6-0	0-2 ft	0.24	
IM-B-6-5	5-7 ft	0.07	
IM-B-7-0	0-2 ft	0.46	
IM-B-7-5 (MS/MSD)	5-7 ft	0.11/0.10	
IM-B-7-5	5-7 ft	0.10	
IM-B-10-0	0-2 ft	0.48	
IM-M-1-0	Sediment	3.0	
IM-M-2-0	Sediment	1.4	

V = Second column value

Dieldrin was only pesticide detected.

NAS Memphis RFI
Interim Measure - SWMUs 4 & 5

Table TM-5 (1 of 3)
Summary of Validated Positive Results
Inorganic Analytical Data
(mg/kg)

	Sample IM-B-1-0 (0-2 ft)	Sample IM-B-1-4 (4-6 ft)	Sample IM-B-1-16 (16-18 ft)	Sample IM-B-2-0 (0-2 ft)	Sample IM-B-2-5 (5-7 ft)	Sample IM-B-2-10 (10-12 ft)	Sample IM-B-3-0 (0-2 ft)	Sample IM-B-3-5 (5-7 ft)	Sample IM-B-3-10 (10-12 ft)
Lead	6.2	7.3	6.2	19.0	6.2	6.2	19.3	6.3	5.2
Nickel	14.0	12.6	8.9	17.2	12.9	17.3	12.8	22.9	11.7
Silver	1.1			1.2				1.2	
Arsenic		0.57	0.57		1.8	9.7		4.6	6.0
Barium	154	173	58.4	273	158	152	146	276	76.1
Beryllium	0.51	0.66	0.27	0.95	0.57	0.36	0.51	0.49	0.27
Cadmium	0.61						0.87	0.78	
Chromium	12.0	12.0	6.4	10.3	11.8	9.4	14.5	9.8	8.8
Cobalt	6.6	2.5	4.9	7.3	2.3	5.0	5.5	7.8	3.8
Copper	17.8	11.2	7.7	11.3	10.4	11.3	12.8	12.9	9.7
Vanadium	18.4	8.6	10.6	21.5	12.0	14.5	15.9	17.9	11.5
Zinc	46.5	61.3	31.4	47.9	53.3	47.9	53.4	53.2	33.8

NAS Memphis RFI
Interim Measure - SWMUs 4 & 5

Table TM-5 (2 of 3)
Summary of Validated Positive Results
Inorganic Analytical Data
(mg/kg)

	Sample IM-B-5-0 (0-2 ft)	Sample IM-B-5-5 (5-7 ft)	Sample IM-B-5-10 (10-12 ft)	Sample IM-B-6-0 (0-2 ft)	Sample IM-B-6-5 (5-7 ft)	Sample IM-B-6-10 (10-12 ft)	Sample IM-B-7-0 (0-2 ft)	Sample IM-B-7-5 (5-7 ft) (MS)	Sample IM-B-7-5 (5-7 ft)
Mercury								0.57	
Lead	14.4	10.6	7.8	12.3	14.8	3.9	22.6	9.5	7.4
Nickel	13.8	11.4	16.5	22.5	13.5	11.6	11.1	57.3	13.8
Silver	1.0								
Arsenic	5.7	1.5	6.8	3.7	4.1	1.5	5.9	3.1	
Barium	194	153	178	273	175	92.5	148	298	125
Beryllium	0.72	0.54	0.38	0.75	0.59	0.38	0.60	5.0	0.47
Cadmium				0.76			0.97	5.1	
Chromium	9.6	11.4	9.2	12.3	12.2	10.4	10.7	29.4	11.2
Cobalt	6.8	4.0	8.8	7.4	5.4	3.2	4.5		2.5
Copper	11.1	10.7	11.8	12.7	13.1	8.6	10.7	30.9	8.8
Vanadium	19.7	12.0	16.4	19.6	14.7	10.8	18.1	57.1	12.0
Zinc	44.5	53.2	44.2	58.4	58.8	47.3	50.9	90.7	47.8

NAS Memphis RFI
Interim Measure - SWMUs 4 & 5

Table TM-5 (3 of 3)
Summary of Validated Positive Results
Inorganic Analytical Data
(mg/kg)

	Sample IM-B-10-0 (0-2 ft)	Sample IM-B-10-5 (5-7 ft)	Sample IM-B-10-11 (11-13 ft) Duplicates	Sample IM-M-1-0 (Sediment)	Sample IM-M-2-0 (Sediment)	Sample IM-M-3-0 (Sediment)	Sample IM-M-4-0 (Sediment)	Sample IM-M-5-0 (Sediment)	Sample IM-B-6-0 (Sediment)	Sample IM-B-7-0 (Sediment)
Cyanide									3.6	
Mercury									0.62	0.20
Tin		249					94.6	450		
Lead	14.9	5.9	6.2/5.8	44.0	25.2	31.2	39.0	18.8	63.7	66.6
Nickel	7.2	33.1	11.2/10.5	10.2	11.2	11.5	22.0	47.0	32.8	14.9
Silver										
Arsenic	4.6	8.3	1.4/2.1	5.7	6.9	3.6	3.5	1.9	12.2	5.3
Barium	80.3	201	35.5/33.2	105	111	162	235	200	196	106
Beryllium	0.50	0.45	0.25/0.23	0.44	0.47	0.56	0.59	0.61	0.61	0.43
Cadmium						0.82	1.0	2.3	5.7	4.8
Chromium	5.9	44.8	6.7/6.9	8.0	8.0	10.3	25.5	83.5	25.6	18.7
Cobalt	4.4	4.7	3.7/3.1	3.9	4.8	4.0	4.1	2.9	19.9	4.8
Copper	8.7	11.4	9.1/9.8	11.1	11.2	16.7	28.6	29.0	21.4	21.4
Vanadium	13.7	17.6	11.1/12.7	14.9	16.1	15.3	14.5	10.1	22.8	12.6
Zinc	25.9	34.3	29.5/33.2	63.0	49.9	82.2	85.1	96.2	170	80.5

ATTACHMENT C

Risk Calculation

TABLE 1–SOIL EXPOSURE RISK (HAZARD INDEX)
UNDER A INDUSTRIAL/COMMERCIAL EXPOSURE SCENARIO
NAS–MEMPHIS, MEMPHIS, TENNESSEE

PARAMETER	SLOPE FACTOR ORAL (MG/KG/DAY)–1	REFERENCE DOSE ORAL (MG/KG/DAY)	CANCER RISK @ AVERAGE	CANCER RISK @ MAXIMUM	HAZARD INDEX @ AVERAGE	HAZARD INDEX @ MAXIMUM	AVERAGE SOIL CONCENTRATION (0 TO 3 FEET) (MG/KG)	MAXIMUM SOIL CONCENTRATION (0 TO 3 FEET) (MG/KG)
PESTICIDES								
Dieldrin	16	0.00005	8.22E–06	2.15E–05	1.26E–02	4.46E–02	0.87	3

NOTE: RfD and Slope Factor (a.k.a. Cancer Potency Factor) values obtained from IRIS and/or HEAST (1991 & 1992); IRIS Search Date 1/18/93.
Inhalation exposure is not a factor for these parameters; inhalation exposure pathway risk is not considered appropriate due to the non–volatility (or limited volatility) of the compounds in the soil sorbed state.
The highest concentration of each parameter detected in site soils (at a depth of three feet or less) and the average concentrations was used to compute risk (or hazard quotient); average was computed on the basis of positive results only.
Exposure assumed to be similar in nature to an agricultural scenario, therefore a daily ingestion of 100 mg soil was assumed at a frequency of 250 days/year.

TABLE 2 – AIR PATHWAY EXPOSURE EVALUATION
REQUIRED MASS OF SOIL TO EXCEED TLVs
PARTICULATES–NOT OTHERWISE REGULATED
NAS–MEMPHIS
MEMPHIS, TENNESSEE

SOURCE CONSTITUENT	SOIL AVERAGE CONCENTRATION (UG/KG)	THRESHOLD LIMIT VALUE (MG/M3)	PEL TLV DESIGNATION OR QUALIFIER	SUSPENDED SOIL REQUIRED TO EXCEED PEL (MG/M3)	(GRAMS/M3)	COMPUTED LIGHT OBSCURATION (%)
PESTICIDES/PCBS:(UG/KG)						
DIELDRIN	870.0	0.25	TWA	2.87E+05	2.87E+02	86.2069